hydrogen such that said hydrogen passivates at least some of said acceptor impurities;

lowering said acceptor-doped layer to a second temperature significantly lower than said first temperature during a cool-down process, thereby causing said acceptor-doped layer to be a p-type layer, having p-type conductivity and a hole density between approximately $3 \times 10^{15} \text{cm}^{-3}$ and $1 \times 10^{18} \text{cm}^{-3}$, after said cool-down process; and

annealing said p-type layer at a temperature below 625°C to remove hydrogen from said p-type layer thereby increasing said hole density and lowering the resistivity of said p-type layer.

32.(New) The method of Claim 31 further comprising substantially preventing additional hydrogen from diffusing into said acceptor-doped layer during said cooling process

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33.(New) The method of Claim 31 wherein said preventing additional hydrogen from diffusing into said acceptor-doped layer comprises preventing gases containing hydrogen from entering said chamber during said cool-down process and removing hydrogen in said chamber during said cool-down process.

34.(New) The method of Claim 31 wherein said preventing additional hydrogen from diffusing into said acceptor-doped layer comprises forming an n-type semiconductor layer cap over said acceptor-doped layer prior to said cool-down process.

35. (New) The method of Claim 31 further comprising treating a surface of said acceptor-doped layer to increase said hole density at said surface to be greater than 3×10^{15} cm⁻³.

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36. (New) The method of Claim 35 wherein said treating said surface comprises chemically exching said surface.

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37. (New) The method of Claim 35 wherein said treating said surface comprises plasma etching said surface.

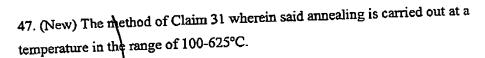
- 38. (New) The method of Claim 35 wherein said treating said surface comprises plasma cleaning said surface.
- 39. (New) The method of Claim 35 wherein said treating said surface comprises chemically cleaning said surface.
- 40. (New) The method of Claim 39 wherein said chemically cleaning said surface comprises cleaning said surface in a solution of at least one of KOH, NaOH, and NH₄OH.
- 41. (New) The method of Claim 35 wherein said treating said surface comprises ultrasonically cleaning said surface.
- 42. (New) The method of Claim 35 wherein said treating said surface comprises irradiating said surface with an electron-beam.
- 43. (New) The method of Claim 35 wherein said treating said surface comprises exposing said surface to electromagnetic radiation.
- 44. (New) The method of Claim 31 wherein said growing an acceptor-doped layer results in acceptor impurities in said acceptor-doped layer having greater than 90% passivation prior to said cool-down process.
- 45. (New) The method of Claim 31 wherein, after said cool-down process, said hole density is greater than 3×10^{16} cm⁻³.
- 46. (New) The method of Claim 31 wherein said introducing acceptor impurities comprises doping said semiconductor layer to have a density of acceptor impurities greater than $5 \times 10^{18} \text{cm}^{-3}$.

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- 48. (New) The method of Claim 31 wherein said annealing is carried out at a temperature below 400°C.
- 49. (New) The method of Claim 31 wherein said growing in a chamber an acceptor-doped layer is performed in a chamber different from a chamber in which said p-type layer is annealed.
- 50. (New) The method of Claim 31 wherein said annealing is carried out after said cool-down process prior to any further processing of said p-type layer.
- 51. (New) The method of Claim 31 wherein said growing in a chamber an acceptor-doped layer further comprises growing a III-V nitride compound ndoped semiconductor layer to form a light emitting diode.
- 52. (New) The method of Claim 51 wherein said acceptor-doped layer is grown subsequent to said n-doped semiconductor layer.
- 53. (New) The method of Claim 31 further comprising growing additional one or more III-V mitride compound acceptor-doped layers and causing said additional one or more acceptor-doped layers to be p-type prior to said annealing.
- 54. (New) The method of Claim 31 wherein said annealing is carried out solely to remove said hydrogen from said p-type layer.
- 55. (New) The method of Claim 31 wherein said annealing is carried out to remove said hydrogen from said p-type layer as well as to anneal or alloy a ptype ohmic contact.

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56. (New) The method of Claim 31 wherein said growing said acceptor-doped layer comprises glowing a group III-V compound semiconductor including gallium and nitrogen.

- 57. (New) The method of Claim 31 wherein said acceptor impurities comprise magnesium.
- 58. (New) The method of Claim 31 wherein said annealing is carried out in a gas environment containing N2.
- 59. (New) The method of Claim 31 wherein the resistivity of said p-type layer prior to said annealing is less than 5000 ohm-cm.
- 60. (New) The method of Claim 31 wherein the resistivity of said p-type layer prior to said annealing is less than 30 ohm-cm.--

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